REMARKS

Please note that the claim amendments provided above are offered for the purpose of rewording the claims so that they more clearly describe and claim the elements of the Applicants invention with respect to the limitations of the Applicants template/image comparison system and method as described by the specification of the patent application into existing claims. Consequently, no new matter has been added to the claims, and no new search is required.

Further, please note that the amendments to the specification are made in order to better clarify the relationship between the elements of the Applicants invention. Further, the specification, as amended, now also includes a discussion of well known techniques and systems relating to OpenGL® graphics standards and hardware, as described in "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999, the subject matter of which has been incorporated into the specification by reference. This material has been incorporated into the specification in order to address the Examiner's concerns regarding the relationships between the various sections of the Applicant's specification. Further, as this material is well known to those skilled in the art, it should not be considered as new matter. Finally, in accordance with the requirements of 37 C.F.R § 1.125, a substitute specification incorporating the changes to the specification identified above is provided along with this amendment so as to improve the readability of the specification in light of the extensive amendments provided. ***Again, no new matter is included in either the amendments or in the substitute specification.***

This application is believed to be in condition for allowance because the claims, as amended, are non-obvious and patentable over the cited references. The following paragraphs provide the justification for this belief. In view of the following reasonings for allowance, the applicants hereby respectfully request further examination and reconsideration of the subject patent application.

1.0 35 U.S.C. §112, First Paragraph Rejections:

Paragraph 10, page 9, of the Office Action of May 16, 2003 includes the "Examiner's Response" to the Applicants' arguments received on March 5, 2003. The Examiner's Response is presented after the claim rejections advanced in the Office Action of May 16, 2003. However, the Examiner's Response will be addressed first so as to better explain the Applicant's arguments with respect to those rejections. In general, in the Examiner's Response, the Office Action raises a number of issues that the Examiner feels are not adequately described in the specification. In particular, the Examiner raises the following questions and concerns which will be addressed below in the order that these issues were raised:

a) "In response to the applicant's first point a), that a graphics rasterizer can be used to compute statistics, the portion of the specification is replete with language that appears to have no antecedent basis in the specification and therefore has nothing to do with the invention described in the general overview. This portion of the specification describes that the address generator interpolates parameters. What parameters is the device interpolating? This is the first time that any parameters are mentioned in the specification. Furthermore, this section describes that a second memory device is used to compute an interpolated texture value. How does a memory device interpolate a texture value? What texture value is being interpolated? Next, this portion of the specification describes that comparison statistics between two colors are gathered. For what colors are statistics being gathered? This is the first time in the specification that colors are even mentioned. Finally, this portion of the specification describes that statistics are gathered depending on the results of an acceptance test. To what acceptance test is the applicant referring? Where has an acceptance test ever taken place prior to this in the description?"

b) "Regarding point b), the applicant has stated in the remarks that a point of novelty of the invention is that a graphics rasterizer can be used for

computing statistical information which can be compared (see remarks: page 9, paragraph 2). However, when this 'portion of novelty of the applicant's invention' is described in the specification on page 3, line 18 -- page 4, line 2, the applicant states that 'statistical generation can be performed by the rasterizer (emphasis added). No further description is given... If this is a point of novelty of the invention, a better description than the rasterizer can perform statistical generation needs to be provided."

c) "Regarding point c), it is unclear from the cited portion of the specification that textured triangle rasterization is equivalent to sparse matching of a template with an image. This portion of the specification merely states that a template is treated as a texture and instead of rasterizing the texture into a frame buffer, statistics are calculated. This portion of the specification never describes a comparison and it is unclear how this process is equivalent to a comparison as argued by the applicant. Furthermore, this portion of the specification calls for resampling the template using a perspective transformation. This is the first time in the specification that a perspective transformation is mentioned. What is a perspective transformation as used by the applicant?"

d) "Regarding point d), while the applicant mentions an alpha blending device in the specification, a clear definition of the functions of this device is never described. What purpose does this device serve? On page 14, lines 13-19, the specification describes that the 'alpha values can be used to compute statistics'. However, the specification never describes how this function is actually performed. It merely states that it "can be" performed. Furthermore, the text of page 15, line 26 - page 16, line 2 does not clearly state the function of the alpha blending device. What does the alpha blending device use the "additional... color component" for? The specification never clearly states the use of this additional color component. It merely states that it 'corresponds to the opacity of a surface'."

1.1 Applicant's Reply to Point (a) of the Examiners Response:

In point (a), as quoted above, the Office Action raises a number of issues relating to texture interpolation and address generators. However, as is well known to those skilled in the art of graphics processor hardware and the like, rendering using conventional graphics processors or the like typically involves drawing geometric shapes or primitives, such as polygons, into dedicated memory. For example, in a simple example of rasterization provided for purposes of explanation, a single triangle may be rendered by taking three vertices v_0, v_1, v_2, with the following fields *sx, sy,* (the screen space coordinates of the triangle in the first memory device) *tu, tv, rhw,* (the 2D coordinates of each vertex in the texture, and a perspective term). A ***conventional*** address generator of a ***conventional*** graphics processor then interpolates these parameters (v_0, v_1, v_2, etc.) across the triangle. Thus, for each pixel in a conventional frame buffer or a "***first memory device***" subtended by the triangle in screen space (sx, sy), pixel values in a conventional texture memory or a "***second memory device***" are used by the address generator to compute an interpolated texture value at the corresponding interpolated texture location. These concepts are very well known to those skilled in the art, and have therefore not been described in extensive detail in the specification of the patent application.

However, to address the Examiner's concern relating to these points, the specification has been amended to more clearly explain the Applicant's inventive concepts with respect to these issues, and to include a reference to a well known publication which describes these concepts in significantly greater detail. (*See amended and newly added paragraphs 13-15 as provided above, and as included in the substitute specification beginning on page 15, line 22 through page 17, line 19.*) In particular, as should be clear to those skilled in the art, the interpolation procedure noted above is equivalent to a conventional resampling operation being applied to the texture, which involves filtering the texture at different locations and at different densities. Such resampling operations are described in the context of conventional "texture minification" and "texture magnification" operations in Section 3.8.5 and 3.8.6 of "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999. This well known reference has been incorporated into the Applicant's specification by reference.

However, as the reference is well known to those skilled in the art, and serves only to provide further clarification of the issues raised by the Office Action, the inclusion of this reference should not be considered to be new matter.

Further, in point (a), as quoted above, the Office Action raises a number of additional issues relating to gathering comparison statistics between two colors. The Office Action suggested that it was unclear as to "what colors" statistics were being gathered for. In particular, the Office Action comments that "[t]his is the first time in the specification that colors are even mentioned." The Applicant's respectfully suggest that because the Applicants are describing the use of pixel-based graphics hardware, that it should be apparent that each pixel has an associated color value. Further, in view of the preceding discussion, and in view of the specification, as amended, it should be clear that comparison statistics are gathered between corresponding pixel color values between the "first memory device" (i.e., the frame buffer) and the "second memory device" (i.e., the texture memory).

Finally, point (a) above raises the issue of "acceptance tests." In particular, the Office Action suggests that "this portion of the specification describes that statistics are gathered depending on the results of an acceptance test. To what acceptance test is the applicant referring? Where has an acceptance test ever taken place prior to this in the description?" In response, the Applicants respectfully suggest that per-pixel acceptance tests are very well known to those skilled in the art of graphics hardware for determining whether pixels are to be rendered or drawn, i.e., whether those pixels are ***visible***. For example, such per-pixel acceptance tests include "alpha tests" for checking to see whether a pixel being drawn has a 0 alpha. With conventional graphics cards, a pixel having an alpha value of 0 is simply skipped rather than being drawn. However, in the context of the present invention, since there are two different pixels that are being compared, the comparison is skipped if either pixel has a 0 alpha value. Another well known conventional per-pixel test performed by the acceptance tester in one embodiment is a "depth buffer" test for determining whether the current pixel being drawn is visible, based on its current z-buffer value. In the context of the present invention, this test is used in one embodiment to only compare a template against the visible portion of a 3D scene. Further, it should be

noted that both of these conventional acceptance tests, i.e., the alpha test and the depth or z-buffer tests, are indicated within elements 416 and 516 of FIG. 4 and FIG. 5, respectively.

Another example of the use of such statistics in combination is provided in the substitute specification on page 24, line 16-22, which explains that "Another advantage of integrating the rasterization and matching stages (via the statistics/comparison device 518) is that the graphics hardware is then capable of performing the visibility computation for 3D model-based tracking. The 3D model would be rendered once in order to compute the z-buffer, and then it would be rendered again to compute the (per-triangle) statistics. Note that rendered pixels which fail the z-buffer test (i.e., the depth buffer test) would be discarded from the computation, since they are not visible." Note that this paragraph was amended in part to correct a typographical error that was inconsistent with the original specification to amend the phrase "discarded from the computation, since they are visible" to read "discarded from the computation, since they are ***not*** visible" (emphasis added).

Other conventional per-pixel acceptance tests and operations include scissor tests, stencil tests, blending, dithering, logical operations, etc., as described in the aforementioned reference: "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999. Note that the specification has been amended to include a discussion of this well known material to address the concerns raised by the Office Action (see the newly added paragraphs, number 9, as presented above in the amendment to the specification).

1.2 Applicant's Reply to Point (b) of the Examiners Response:

In point (b), as quoted above, the Office Action raises a number of issues relating to using a graphics rasterizer for computing and comparing statistical information. In particular, the Office Action states that "[i]f this is a point of novelty of the invention, a better description than the rasterizer can perform statistical generation needs to be provided. The Applicants believe that the original specification, in view of both FIG. 4 and FIG. 5, provided an adequate and enabling description. For example, the specification as

originally filed explains that the graphics rasterizer contains "additional core logic" that is used to gather and compute statistics. Further, as described in the substitute specification in the "Working Example" provided in Section V, beginning on page 21, line 7, through page 24, line 22 and as supported by FIG. 4 and Fig. 5, the modified graphics processor of the Applicants claimed invention includes "***additional core logic represented by the statistics/compare device 518 and the statistics enable switch 520***" (emphasis added) (see page 22, lines 5-9). Further, both FIG. 4 and FIG. 5 illustrate the use of the statistics/comparison device (418 and 518, respectively) in combination with conventional graphics rasterizer hardware which includes an address generator 514, and an acceptance tester 516 which both interface with memory elements including a frame buffer 512 and a texture memory 510. Further, when the cited text and figures are read and understood in light of the substitute specification, the Applicants believe that the specification as amended now includes the "better description" required by the Office Action.

1.3 Applicant's Reply to Point (c) of the Examiners Response:

In point (c), as quoted above, the Office Action raises an issue relating to how textured triangle rasterization is equivalent to sparse matching of a template with an image. As discussed in the previous response, the Applicants believe that the original specification provided an adequate and enabling description relating to this point. In fact, note that the Office Action acknowledges that the specification as originally filed states that "***a template is treated as a texture and instead of rasterizing the texture into a frame buffer, statistics are calculated***" (emphasis added). This statement nicely summarizes this feature of the Applicants claimed invention. Further, in view of the well known art relating to triangle rasterization performed using conventional graphics processors, the plain meaning of the Applicants explanation should be well understood by those skilled in the art. However, in order to address the concerns raised by the Office Action, the Applicants have more fully explained conventional rasterization as it is known to those skilled in the art so that an understanding of its relationship to sparse matching of templates with an image can be better understood. The Applicants believe that the text cited below adequately addresses the concerns raised by the Office Action with respect to

how textured triangle rasterization is equivalent to sparse matching of a template with an image.

In particular, as described in the substitute specification on page 14, line 14, through page 15, line 6:

> "It has been observed that textured triangle rasterization performed in a conventional graphics processor or the like closely resembles sparse matching of a template with an image. In support of this observation, the following discussion will include a brief overview of conventional rendering techniques as known to those skilled in the art. As described herein, these rendering techniques have been adapted for the purpose of template matching. For example, as is well known to those skilled in the art, triangle rasterization performed using conventional graphics processors involves fetching a set of pixels arranged in a regular order in one or more subsets of graphics memory (the source *texture maps*), combining or operating on these values, and then drawing these into a frame buffer. (See for example, "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999). ***Similarly, sparse template matching involves fetching two regular subsets of graphics memory and then comparing the values to accumulate some statistics. Therefore, the only difference between traditional graphics rasterization (rendering) and sparse template matching is the statistical comparison of pixels and the accumulation of these statistics, as described below. Therefore, an understanding of conventional triangle rasterization will enable those skilled in the art to fully understand sparse matching of a template with an image as described herein***." (emphasis added)

The Office Action also notes in point (c) that the "specification calls for resampling the template using a perspective transformation. This is the first time in the specification that a perspective transformation is mentioned. What is a perspective transformation as used by the applicant?" Note that perspective transformations as related to conventional graphics hardware are well known and understood by those skilled in the art. However, in

order to address the concerns raised by the Office Action, the Applicants have included a reference to Section 2.10 of "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999, in the substitute specification. This well known conventional reference cites and explains a number of conventional perspective transforms. Further, as such perspective transforms are extremely well known to those skilled in the art of 3D graphics hardware, the Applicants to not believe that further explanation is required. Finally, when these concepts are read in view of the substitute specification, the Applicants believe that their meaning is both clear and enabling.

1.4 Applicant's Reply to Point (d) of the Examiners Response:

In point (d), as quoted above, the Office Action raises an issue relating to the alpha blending device detailed in the specification. The Office Action suggests that a clear definition of the functions of the alpha blending device is not provided, and asks the question: "What purpose does this device serve?" Further, the Office Action notes that the original specification, on page 14, lines 13-19, describes that the 'alpha values can be used to compute statistics,' but that "the specification never describes how this function is actually performed."

In response, the Applicants would like to point out that the "alpha blending device" described in the specification is a conventional alpha blending device as used in any of a number of conventional computer graphics cards. As such devices are extremely well known to those skilled in the art, no detailed description was provided in the original specification. In fact, the description in the original specification was included merely to point out the conventional function of the use of alpha values. In particular, as is well known to those skilled in the art, conventional alpha values represent an additional color component (i.e., the alpha value in a typical RGB***A*** signal) that is conventionally used to represent the opacity of a surface.

However, in the context of the present invention, the alpha values associated with particular pixels are instead used in one embodiment to perform weighting of the statistics

computed by the statistics/comparison device (see 518 of FIG. 5). For example, as described, with respect to FIG. 5 in the substitute specification, in the "Working Example" provided in Section V, beginning on page 21, line 7, through page 24, line 22 and as fully supported by Fig. 5, the modified graphics processor of the Applicants claimed invention includes a "statistics enable switch 520." Specifically, as described in the substitute specification on page 21, line 27 through page 22, line 28, in one embodiment, enabling of the statistics enable switch 520 passes the RGBA color values through the statistics/comparison device 518 rather than through the alpha blending device 522. Consequently, rather than using the alpha components of the RGBA values for alpha blending, they are instead used for weighting the statistics computed by the statistics/comparison device 518. When these concepts are read in view of the substitute specification, the Applicants believe that their meaning is both clear and enabling.

Finally, note also that in the both the rejections and the "Examiner's Response" sections of the Office Action, the Office Action objects to the use of the term "can be" as being indefinite. Note that throughout the substitute specification, the term "can be" has been replaced with terms such as "is" and "are" where appropriate in order to address this concern.

Having addressed the comments in the "Examiner's Response" section of the Office Action, the following sections of this response will now address the rejections advanced in the Office Action of May 16, 2003.

2.0 Rejection of Claims 6-20 under 35 U.S.C. §112, First Paragraph:

The Office Action of May 16, 2003 rejected claims 6-20 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. In particular, the Office Action suggests that the claims contain subject matter which was not described in the specification is such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. However, in view of the amendments provided in the substitute specification

filed herewith, the applicants respectfully suggest that the claims, as amended, fully comply with the written description requirement of 35 U.S.C. §112, first paragraph.

2.1 Rejection of Claims 6-20:

In paragraph 3 of the Office Action, claims 6 and 9 were rejected under 35 U.S.C. §112, first paragraph. In particular, the Office Action notes that claims 6 and 9 were amended to include the limitations "using a 3D graphics rendering device" and "a 3D graphics rendering processor," respectively. The Office Action then suggests that "no where in the specification is a 3D graphics rendering device or processor described," and asks the question whether a 3D graphics rasterizer is equivalent to a 3D graphics rendering device. Further, the Office Action correctly points out that "[n]owhere in the specification or in the figures are two graphics processors described in the same system."

In response, the Applicants would like to point out that the both the original and substitute specification refers to "graphics processors," "graphics rasterizers," "3D graphics rasterizers," "video graphics devices," and "hardware video cards" as ***alternate terms*** for conventional 3D computer video or graphics cards and the like. As such graphics cards are very well known to those skilled in the art, there is no need to provide either a detailed description of such computer graphics cards or of their architecture within the specification of the patent application. With respect to the amendment to claim 9 reciting both a "raster processor" and a "3D graphics rendering processor," the Applicants note that the use of both terms was in error, as it was not the intent of Applicants to claim the use of two graphics cards. Further, as pointed out by the Office Action, the use of two separate graphics cards in this manner would not be consistent with the specification or figures as originally filed. In fact, the current amendments to claim 9 instead make it clear that the statistics are being accumulated and compared using a "statistical compare processor." Note that this "statistical compare processor" corresponds to the "statistics/comparison device" (element 418) of FIG. 4, and to the "statistics/comparison device" (element 518) of FIG. 5.

In particular, claim 9 now recites the following novel language:

> "A system for tracking digital templates of a digital scene defined by plural images, comprising:
>
> a ***computer graphics card including a raster processor*** that transforms at least one of the templates;
>
> a statistics enable switch included in the computer graphics card, wherein accumulation of information for each digital template is enabled when said statistics enable switch is enabled, and wherein said computer graphics card provides the at least one transformed template to a frame buffer included in the computer graphics card when said statistics enable switch is disabled; and
>
> a ***statistical compare processor*** included in the computer graphics card that accumulates information for each digital template and statistically compares and matches images associated with the templates for tracking the templates based on the accumulated information when said statistics enable switch is enabled." (emphasis added)

Consequently, in view of the above discussion, the amendments to the specification provided via the substitute specification filed herewith, and the amendments to both claims 6 and 9, the Applicants respectfully submit that the claims, as amended, fully comply with the written description requirement of 35 U.S.C. §112, first paragraph. Consequently, the Applicants respectfully request reconsideration and further examination of claims 6 and 9, and of claims 7-8, and 10-20, respectively, which depend therefrom.

2.2 Rejection of Claims 6-20:

In paragraph 4 of the Office Action, claims 6 and 9 were rejected under 35 U.S.C. §112, first paragraph as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In particular, the Office Action suggests that the "specification describes certain (presumed) implementations of the comparison process that is not well understood as disclosed." Specifically, the Office Action suggests that although Section III of the specification discusses model generation, the interpolation of texture and the computing of statistics between color values, Section III of the specification does not discuss image comparison, and that there is "no apparent link to the image comparison disclosure of Section II." The Office Action then summarizes the misunderstood portions of the specification by suggesting that "there seem to be two distinct disclosures in the specification that are not related or reliant upon one another. While the examiner understands those portions of the specification relating to the comparison of two images (e.g. Fig. 2), the examiner does not understand how the image comparison is related to the model generation as depicted in Figs. 3-5."

While the Applicants believe that the application as originally filed was clear on its face in view of both the detailed description and the figures, the Applicants have provided a number of amendments to the specification, including a discussion of well known conventional processes relating to conventional computer graphics cards in order to provide a description which should be more clear to the Examiner. Note that a discussion of these amendments is provided above in Sections 1.1 through 1.4 of this response. Note that, as discussed above, these amendments more clearly explain how conventional rendering processes can be adapted for use in image or model comparisons.

For example, as described by the Applicants in the substitute specification filed herewith on page 15, line 22, through page 16, line 24, the "rendering" discussed by the Applicants is clearly describing rendering as it is implemented in a typical graphics rasterizer or 3D graphics rendering device. Such graphics rasterizers are well known to those skilled in the art, and are typically found in conventional 3D graphics hardware, such as, for example, a computer 3D graphics or video card. As noted in the previous response, a portion of the novelty of the Applicants invention resides in the adaptation of the use of such graphics hardware for computing statistical information which can then be compared as described. In particular, page 15, line 22, through page 16, line 24 of the

substitute specification describes rendering and its adaptation for use in comparisons with the following language:

"Rendering using conventional graphics processors or the like typically involves drawing geometric shapes or primitives, such as polygons, into dedicated memory. It should be noted that the present invention preferably uses triangles as the drawing primitive, although there are other primitive types that could be used. In general, in a simplified example of rasterization provided for purposes of explanation, a single triangle is rendered by taking three vertices v_0, v_1, v_2, with the following fields *sx, sy,* (the screen space coordinates of the triangle in the first memory device) *tu, tv, rhw,* (the 2D coordinates of each vertex in the texture, and a perspective term). In particular, the address generator 414 of a conventional graphics processor interpolates these parameters (v_0, v_1, v_2, etc.) across the triangle; for each pixel in the first memory device subtended by the triangle in screen space (sx, sy), pixel values in second memory device are used by the address generator 414 to compute an interpolated texture value at the corresponding interpolated texture location.

Note that the operations described in the preceding paragraph are equivalent to a conventional resampling operation being applied to the texture, which involves filtering the texture at different locations and at different densities. For example, such resampling operations are described in the context of conventional "texture minification" and "texture magnification" operations in Section 3.8.5 and 3.8.6 of the aforementioned "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999 .

The present invention builds on these resampling operations by gathering comparison statistics between the RGB color values of the corresponding pixels between the two memory devices 410 and 412, using the statistics/comparison device 418, depending on the results of the acceptance test performed by the acceptance tester 416. For example, as noted above, if the alpha or z-buffer values for particular pixels indicate that

those pixels are not visible (e.g., a 0 alpha value), then statistics will not be gathered by the statistics/comparison device 418 for those pixels." (emphasis added)

The Applicants continue by then clearly adapting the capabilities of the graphics rasterizer to the present invention. In particular, because textured triangle rasterization resembles sparse matching of a template with an image, the Applicants describe on page 16, lines 3-13 that the texture memory and frame buffer of 3D rasterization hardware can be adapted to process the template and image to be matched in accordance with the Applicants' invention. Specifically, page 14, line 16, through page 15, line 6, of the substitute specification explains that:

"It has been observed that textured triangle rasterization performed in a conventional graphics processor or the like closely resembles sparse matching of a template with an image. In support of this observation, the following discussion will include a brief overview of conventional rendering techniques as known to those skilled in the art. As described herein, these rendering techniques have been adapted for the purpose of template matching. For example, as is well known to those skilled in the art, triangle rasterization performed using conventional graphics processors involves fetching a set of pixels arranged in a regular order in one or more subsets of graphics memory (the source *texture maps*), combining or operating on these values, and then drawing these into a frame buffer. (See for example, "*The OpenGL® Graphics System: A Specification (Version 1.2.1)*," Copyright © 1992-1999 Silicon Graphics, Inc., April 1, 1999). Similarly, sparse template matching involves fetching two regular subsets of graphics memory and then comparing the values to accumulate some statistics. Therefore, the only difference between traditional graphics rasterization (rendering) and sparse template matching is the statistical comparison of pixels and the accumulation of these statistics, as described below. Therefore, an understanding of conventional triangle rasterization will enable those skilled in the art to fully understand sparse matching of a template with an image as described herein."

Further, page 14, line 16, through page 15, line 6, of the substitute specification explains that:

> "As noted above, it has been observed that textured triangle rasterization performed in a conventional graphics processor or the like closely resembles sparse matching of a template with an image. Consequently, in one specific embodiment of the example of FIG. 5, ***the template is treated as a texture and the frame buffer an image and the display primitive for rendering purposes is a triangular polygon***. In addition, ***instead of rasterizing the texture into the frame buffer, certain statistics are recorded for normalized correlation or other statistics can be recorded for various embodiments***. In one example, if the texture is considered a template and the frame buffer an image, the graphics processor 513 is used to resample the template using a perspective transformation. ***Also, the statistics/comparison device 518 of the modified graphics processor 513 is used to record statistics...***" (emphasis added)

Note that as described by the Applicants throughout the substitute specification, these statistics are the basis for the template/image matching performed by the present invention.

Consequently, in view of the preceding discussion, and in view of the amendments to the specification provided via the substitute specification, the Applicants respectfully contend that there is a clear relationship between the use of graphics rendering and statistical comparison of templates/images. Further, in view of the preceding discussion, it is clear that the specification includes descriptive support of the claimed invention that would enable one of ordinary skill in the art to make and use the claimed invention without undue experimentation. Consequently, the Applicants contend that the specification, as amended and provided via the substitute specification submitted herewith, is enabling with respect to claims 6-20, as amended. Therefore, the Applicants respectfully request reconsideration of the rejection under 35 U.S.C. §112 first paragraph of claims 6-20, as amended in view of the proceeding discussion and in view of the detailed description provided in the substitute specification.

3.0 Rejection of Claims 6-20 under 35 U.S.C. §112, Second Paragraph:

The Office Action of May 16, 2003 rejected claims 6-20 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Office Action suggests that the claims 6-20 are drawn to an invention that lacks enablement, and that lacks clear and understandable support in the specification as described above. In particular, the Office Action suggests that "the examiner is uncertain how the disclosed image comparison is related to the disclosed model generation/texture interpolation embodiments as described above." Finally, the Office Action suggests that "the claims can not be understood in light of the disclosure," that "the claims define an invention that lacks support in the disclosure," and that "the claim appear to be inconsistent with the specification and are rejected under 112 second paragraph on this basis."

As noted above, paragraph 5 of the Office Action suggests that "the claim appear to be inconsistent with the specification." However, the Office Action does not refer to a specific claim here, nor does it offer any discussion of any inconsistencies. Thus, for the sake of argument, the Applicants will assume that the Office Action is referring to the problem with claim 9, as discussed above, where the Applicants erroneously amended the claim in the previous response to include a second graphics processor. However, as discussed above, the Applicants have amended claim 9 so that it is not inconsistent with the specification.

Consequently, in view of the discussion provided above, and in Sections 1 and 2 of this response, the Applicants respectfully contend that the specification includes descriptive support of the claimed invention that would enable one of ordinary skill in the art to make and use the claimed invention without undue experimentation. Further, also in view of the preceding discussion, and in view of the substitute specification filed herewith, the Applicants respectfully contend that that the specification, as amended and provided via the substitute specification submitted herewith, is enabling with respect to claims 6-20, as amended. Finally, the Applicants respectfully suggest that the claims, as amended are that it is ***not*** inconsistent with the specification.

Therefore, the Applicants respectfully request reconsideration of the rejection under 35 U.S.C. §112 second paragraph of claims 6-20, as amended in view of the proceeding discussion and in view of the detailed description provided in the substitute specification.

4.0 Rejections Under 35 U.S.C. §102(b):

In the Office Action of November 19, 2002, claims 1-3, 9-7, 19 and 20 were rejected under 35 U.S.C. §102(b), as being anticipated by Neff et al. ("***Neff***," U.S. Patent 5,809,171 A). In addition, claims 1-8 were rejected under 35 U.S.C. §102(b), as being anticipated by Sacks, et al. ("***Sacks***," U.S. Patent 4,736,437 A).

A rejection under 35 U.S.C. §102(b) requires that the Applicant's invention was described in a printed publication more than one year prior to the date of application for patent in the United States. To establish that a printed publication describes the Applicant's invention, *all of the claimed elements of an Applicant's invention must be considered, especially where they are missing from the prior art*. If a claimed element is not taught in the referenced patent, then a rejection under 35 U.S.C. §102(b) is not proper, as the Applicants claimed invention can be shown to be patentably distinct from the cited reference.

4.1 Rejection of Claim 1-3, 9-17 and 19 over *Neff*:

With respect to claims 1-3, 9-17, and 19, the Office Action rejected independent claims 1 and 9 under 35 U.S.C. §102(b) based on the rationale that the ***Neff*** reference discloses the Applicants claimed method for comparing and matching a first set of digital data to at least a second set of digital data. Further, in response to the Applicants previous arguments regarding the ***Neff*** reference, the Office Action suggests that "Fig. 1 of the Neff reference has all of the components of Fig. 4; therefore, the device depicted in Fig. 1 of Neff is a graphics rasterizer."

However, in contrast to the position advanced by the Office Action, the Applicants would like to point out that Fig. 1 of the ***Neff*** reference does ***not*** have all of the components of Fig. 4 of the Applicant claimed invention. In particular, Fig. 1 of the ***Neff*** reference includes several basic components, including: an ***image memory*** 18 for storing captured images; a ***template memory*** 14 for storing a designated target object or template; an ***image processor*** 46 for "for partitioning the template into a number of labels, for determining the total number of pixels N_T which form the template and for determining the number of pixels N_i which form each of the labels *i* "; an ***address generator*** 40 for offsetting, rotating and/or scaling, the template relative to the image (see col. 12, line 66 through page 13, line 27); and ***comparison means*** 28 that "overlays the template T onto the test image TI and compares the pixels of the template and the test image on a pixel-by-pixel basis" (see col. 10, line 63-65), said comparison means acting in cooperation with various correlation means (34, 38 and 49) for correlating and recognizing objects in the test image that match the template.

In stark contrast, Fig. 4 of the Applicants invention illustrates a simple block diagram of a conventional graphics card or integrated graphics processor (boxes 410, 412, 414, and 416) that has been modified to include a statistics comparison device 418. Further, note that the FIG. 4 of the Applicants invention also includes a pixel acceptance tester which performs tests such as alpha tests and z-buffer tests. The Applicants do not believe that ***Neff*** is illustrating a conventional computer graphics card, let alone one that has been modified to include a statistics comparison device. Further, it should be quite clear that the ***Neff*** reference does not include any sort of pixel acceptance testing as illustrated by FIG. 4. Clearly, FIG. 1 of the ***Neff*** reference does not include all of the elements illustrated by FIG. 4 of the Applicants invention. Consequently, it can not be said that FIG. 1 of the ***Neff*** reference is equivalent to FIG. 4 of the Applicants invention.

In addition, it should be noted that the Applicants have further amended claim 1 to make it clearer that raster transforming of the digital data (i.e., template and images) is performed using a ***computer graphics card***. Further, claim 1 has also been amended to make it clearer that the computer graphics card ***also includes*** a "statistical processor" for accumulating statistical information for the digital data, and that the accumulation of that

statistical information depends upon the result of a ***pixel acceptance test performed by an acceptance tester*** included in the computer graphics card. In particular, claim 1 now recites the following novel language:

> "A method for comparing and matching a first set of digital data to at least a second set of digital data, comprising:
>
> using a computer graphics card for raster transforming at least one of the first set of digital data and the second set of digital data;
>
> depending upon the results of a ***pixel acceptance test performed by an acceptance tester included in the computer graphics card***, accumulating statistical information for each of the first set of digital data and the second set of digital data using a ***statistical processor included in the computer graphics card***; and
>
> using the statistical information for each of the first set of digital data and the second set of digital data for statistically comparing and matching the raster transformed sets of digital data to appropriately corresponding portions of each other using the statistical processor." (emphasis added)

Similarly, claim 9, as recited above, has been amended to include the "statistics enable switch" illustrated in FIG. 5. Further, as claimed, this statistics enable switch controls whether statistics are to be gathered, or whether the transformed templates are to be provided to a frame buffer of the computer graphics card. Clearly, ***Neff*** fails to include any equivalent to either the claimed graphics card, or to the Applicants claimed ***statistics enable switch***.

Consequently, because both claims 1 and 9, as amended, include elements not taught by the ***Neff*** reference, the rejection of claims 1 and 9, as amended, under 35 U.S.C. §102(b) is no longer proper. Therefore, the Applicant respectfully requests reconsideration of the rejection of claims 1-3, 9-17 and 19 under 35 U.S.C. §102(b) in view of the aforementioned novel claim language of claims 1 and 9, as amended.

4.2 Rejection of Claims 1-5 over *Sacks*:

As with the ***Neff*** reference, the Office Action attempts to equate the "setup in Fig. 1" of the ***Sacks*** reference to the system illustrated by FIG. 4 of the Applicants claimed invention.

In particular, with respect to claim 1, the Office Action states that ***Sacks*** describes a "graphics rasterizer" in Fig. 1, Fig. 3, and col. 10, line 61- col. 11, line 13. The Office Action notes that the cited figures and text "describes a "video memory ... and a reference memory..." and that the data in the reference memory is "rotated and read out in a scanning line pattern..." The Office Action then concludes that the "setup in Fig. 1 is equivalent to the setup in Fig. 4 of the applicant's specification. Therefore this system is a graphics rasterizer."

However, in contrast to the position advanced by the Office Action, the Applicants would like to point out that Fig. 1 of the ***Sacks*** reference does ***not*** have all of the components of Fig. 4 of the Applicant claimed invention. In particular, the components shown in Fig. 1 of the ***Sacks*** reference include the following elements: a central processing unit (CPU) 10 which "controls the necessary algorithms" for controlling the input and output of the data; a system timer 12 which provides "basic timer for the system"; a video memory 20 which stores a video input 14; a reference memory 16 which stores "reference data concerning a part under investigation"; a rotator 18 for reading out the data in the reference memory 16 along any scan line varying from zero through 360 degrees; and a convolver 22 that "continuously compares the video information from the scene being searched from video memory 20 against the stored data from the reference memory 16 to continuously correlate the information and feed the convolved information to an accumulator 24 under control of both the CPU 10 and a threshold level control 26." (see col. 5, line 64 - col. 6, line 46)

However, in contrast to the position advanced by the Office Action, the Applicants respectfully suggest that it should be clear that neither Fig. 1 nor Fig. 3 of the ***Sacks*** reference includes all of the elements of Fig. 4 of the Applicant claimed invention. In

particular, as discussed above with respect to the ***Neff*** reference, Fig. 4 of the Applicants invention illustrates a simple block diagram of a conventional graphics card or integrated graphics processor (boxes 410, 412, 414, and 416) that has been modified to include a statistics comparison device 418. Further, note that the FIG. 4 of the Applicants invention also includes a pixel acceptance tester which performs tests such as alpha tests and z-buffer tests.

Therefore, the Applicants do not believe that ***Sacks*** is illustrating a conventional computer graphics card, let alone one that has been modified to include a statistics comparison device or an acceptance tester as illustrated by the Applicants in FIG. 4. Clearly, FIG. 1 of the ***Sacks*** reference does not include all of the elements illustrated by FIG. 4 of the Applicants invention. Consequently, it can not be said that FIG. 1 of the ***Sacks*** reference is equivalent to FIG. 4 of the Applicants invention. Consequently, as there foes not appear to be any equivalence, a rejection under 35 U.S.C. §102(b) is not proper.

In addition, as discussed above, it should be noted that the Applicants have further amended claim 1 to make it clearer that raster transforming of the digital data (i.e., template and images) is performed using a ***computer graphics card***. Further, as cited above, claim 1 has also been amended to make it clearer that the computer graphics card ***also includes*** a "statistical processor" for accumulating statistical information for the digital data, and that the accumulation of that statistical information depends upon the result of a ***pixel acceptance test performed by an acceptance tester*** included in the computer graphics card.

Thus, it is clear that the present invention, as claimed by independent claim 1 includes elements not taught in the ***Sacks*** reference. Consequently, the rejection of independent claim 1 and of dependent claims 2-5, as amended, under 35 U.S.C. §102(b) is no longer proper. Therefore, the Applicant respectfully requests reconsideration of the rejection of claims 1-5 under 35 U.S.C. §102(b) in view of the aforementioned novel language of claims 1-5, as amended.

4.3 Rejection of Claims 6-8 over *Sacks*:

In the rejection of claims 6-8, the Office Action states that "[t]he specification does not describe a 3D rendering device. The examiner assumes that this device is equivalent to a graphics rasterizer." The examiner then reiterates the rejection of claim 1 and suggests that claim 6 is rejected for the same reasons.

However, 3D graphics rendering devices are well known to those skilled in the art, and as such need not be described in detail in the specification of the patent application. However, in contrast to the position advanced by the Office Action which suggests that a 3D rendering device is ***not*** described by the Applicants specification, the Applicants would like to point out that the Section III of the Applicants specification contains a lengthy discussion of model rendering using geometric primitives such as triangles. As should be appreciated by those skilled in the art, such model rendering is accomplished using 3D graphics rendering devices such as computer graphics cards and the like.

In fact, unlike the pattern recognizer described by ***Sacks***, the 3D graphics rendering system claimed by the applicants is capable of performing the claimed process of ***rendering model transformations***. ***Sacks*** does appear to be capable of reading a stored video memory from various scan line angles. However, the ability to read a stored video memory from various scan line angles is in no way equivalent to actually rendering a model transformation. Consequently, the Applicants respectfully suggest that ***Sacks*** fails to disclose the Applicants claimed ***3D graphics rendering system*** for ***rendering model transformations***. In particular, claim 6 recites the following novel language:

> "A method for comparing and matching a first set of digital data to at least a second set of digital data, comprising:
>
> loading at least one of the first and second sets of digital data into a first memory device;
>
> using ***a 3D graphics rendering device for rendering model transformations*** and accumulating statistics of the loaded digital data, said ***3D graphics rendering device modified to include a statistical processor***;

adjusting the model transformations based on the accumulated statistics; and

statistically comparing and matching the model transformations of the loaded set of digital data to appropriately corresponding portions of the other set of digital data." (emphasis added)

Thus, it is clear that the present invention, as claimed by independent claim 6 includes elements not taught in the ***Sacks*** reference. Consequently, the rejection of independent claim 6, as amended, and of dependent claims 7-8, under 35 U.S.C. §102(b) is no longer proper. Therefore, the Applicant respectfully requests reconsideration of the rejection of claims 6-8 under 35 U.S.C. §102(b) in view of the aforementioned novel language of claims 6, as amended.

CONCLUSION

In view of the above, it is respectfully submitted that claims 1-20, as amended, are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of claims 1-20, and to pass this application to issue. Additionally, in an effort to further the prosecution of the subject application, the Applicant kindly invites the Examiner to telephone the Applicant's attorney at (805) 278-8855 if the Examiner has any questions or concerns.

Respectfully submitted,

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